TG LABS. G QUIRK

V.H.F. MILLIVOLTMETER
TYPE 711

MC

INSTRUCTION MANUAL

MP MASTER
MA23514

DYMAR ELECTRONICS LIMITED,
REMBRANDT HOUSE, WHIPPENDELL ROAD, WATFORD, HERTS, ENGLAND.

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1. General.

The V.H.F. Millivoltmeter Plug-In Type 711 is a sensitive instrument for the measurement of voltages from 300μV to 3 Volts in the frequency range from 50 kHz to 850 MHz. Its R.F. Probe which contains the diode detector circuit is slim and compact and alternative tips or terminating pads are available. Below approximately 30mV the rectifying diodes exhibit a square law transfer characteristic thus giving true r.m.s. response. As the level increases the response changes gradually to peak-to-peak but it is still calibrated in r.m.s. values of a sine wave.

The low level D.C. voltage from the probe is amplified in a low-noise chopper amplifier and fed to the meter in the Dymar Meter Unit via special linearising circuits which correct for the square law non-linearity at low level. This makes the reading on the meter linear between 1/3 f.s.d. and full scale. It must be remembered that below 1/3 f.s.d. the meter is uncalibrated and the next lowest range must be selected.

Optional accessories which can be supplied with the instrument are a 100:1 capacitive divider which extends the voltage range to 300 Volts, and a T-adaptor for making measurements on 50Ω coaxial circuits.

2. Specification.

Voltage Range:	1mV f.s.d. to 3 Volts (Note 1) (Minimum reading 300μV) 8 ranges in 1, 3, 10 sequence.
Frequency Range:	50 kHz to 850 MHz (Note 2)
Accuracy:	±3% f.s.d. 100 kHz–100 MHz (±5% f.s.d. on 1mV range.)
Frequency Response:	±0·5db 50kHz–100kHz and 100MHz–250MHz ±1.0db 250MHz–850MHz (Note 2)
Probe Input Impedance:	(Without tip or adaptors)
Capacitance	1·5pF at 3 Volts input 3·0pF at 3mV input level.
Resistance:	300KΩ at 1MHz 100KΩ at 10MHz 20KΩ at 100MHz } 1 Volt Input

Note 1 A red "db" scale with ranges from -50db to +20db facilitates relative voltage measurements with 0db set at 0·245 Volts (1mW in 60Ω). To obtain absolute power readings in dbm add 0·8db for 50Ω circuits and subtract 1db for 75Ω circuits.

Note 2 For measurements in the U.H.F. range the T-adaptor and matched load are necessary to obtain specified accuracy.

VSWR > : 1·1:1 @ 850

3. Operation

This section should be read carefully before attempting to use the voltmeter. Insert the Plug-In into a Dymar Meter Unit and to obtain the full accuracy allow 10-15 minutes for the instrument to warm up. Connect the probe making sure that its serial number is the same as that of the Plug-In as each voltmeter is calibrated with its own probe. (The serial number of the Meter Unit is irrelevant).

Short the terminals of the probe and set the range switch to 1mV. Carefully adjust the zero control to obtain minimum reading on the meter. This should be less than 15 divisions on the upper scale. Connect the probe tip across the voltage source to be measured keeping the connections as short as possible to minimise errors due to stray impedances and circulating R.F. currents. Select the appropriate voltage range on the meter to obtain a reading greater than 1/3 of full scale.

Precautions: R.F. voltages in excess of 6 volts can cause permanent damage to the semi-conductor diodes in the probe. The maximum D.C. voltage which can be applied to the probe is 300V.

The normal ambient temperature of the probe for the specified accuracy is 15-30°C and outside these limits errors due to temperature effects of the diodes may occur.

Sometimes it may be difficult to zero the instruments because of stray pick-up from R.F. fields. This may require shielding of the probe.

Spurious readings which are traced due to mains pick-up via earth loops can often be minimised by disconnecting the green earth wire of the mains connector to the Meter Unit.

4. Technical Description.

The circuit description must be read with reference to the attached circuit diagram and component layout of the instrument. The R.F. signal which is applied to the probe is rectified by the diodes MR1 and MR2 which produce a balanced D.C. signal at the socket S.K.1. This is applied to the balanced attenuator R10-R23 before applying it to the chopper CH1. The "Zero" potentiometer RV1 injects a small balacning voltage to offset any spurious voltages due to thermoelectric effects etc.

The mechanical chopper CH1 converts the rectified D.C. voltage into a 50Hz square wave which is amplified in the feedback amplifier V2. The gain of this amplifier is varied from range to range by having different degenerative feedback resistors in the cathode for each range. These resistor fix the sensitivity of the instrument at 1/3 of f.s.d. on each range. The signal is then passed into the selective amplifier V3A and Cathode follower V3B. Frequency selection at the chopper frequency of 50Hz is accomplished by a Twin-Tee Network in the feedback path from the cathode of V3B to the grid of V3A. The chopped signal is now rectified in the voltage double rectifier MR3 and MR5 but before it is passed to the meter for readout it is linearised by the diodes MR4 and MR6 in conjunction with the pre-set potentiometers RV10 to RV17 depending on range. Since the characteristic of the diodes in the probe is either true square law (below 30mV) or a degenerate form of it, until it becomes almost linear (above 1 volt) the effect is to give a larger D.C. output

at the meter terminals than would be the case if rectification was truly linear. The purpose of the linearising diodes MR4 and MR6 is to direct some of the excess current at higher levels away from the meter to ground and the correction is done on each range at the highest input signal for this range, i.e. at full scale deflection.

5. Maintenance

If maintenance and recalibration of the instrument is required it is necessary to have an extension lead which will permit the Plug-In to be operated outside the Meter Unit case. A calibrated source of voltages is required giving 300μV to 3 Volts in 10db steps at a frequency of 100KHz or above. The calibrating procedure is as follows:

Connect the Voltmeter to the calibrated source and set the range switch to 1mV. With the e.m.f. switched to zero obtain minimum reading on the meter by adjusting the Zero control. This should be less than 15 divisions on the upper scale. Apply 300μV and adjust RV2 to obtain a reading of 3 on the upper scale. Increase the voltage by 10db, i.e. to 950μV and adjust RV10 to get a reading of 9·5 (or 3 on the lower scale). Recheck the reading at 300μV and readjust if necessary and again at 950μV. This completes the calibration on the 1mV range. Repeat procedure on other ranges always first adjusting the reading at 3 on the upper scale (1/3 f.s.d.) and then at 9·5 on the upper scale.

The following preset potentiometers are used for the adjustment:

Range	Adjustment for 3	Adjustment for 9·5
1mV	RV2	RV10
3mV	RV3	RV11
10mV	RV4	RV12
30mV	RV5	RV13
0·1V	RV6	RV14
0·3V	RV7	RV15
1V	RV8	RV16
3V	RV9	RV17

It is very important to recheck the calibration after replacement of components in the instrument. If it is necessary to change the input valve V1 this must be selected for low noise.

P A R T S L I S T

CIRCUIT REF.	DESCRIPTION			
	R E S I S T O R S			
R1.	Solid Carbon	100K	±10%	1/10W
R2.	Solid Carbon	A.O.T.	±10%	1/10W
R3.	High Stab.	22MΩ	±5%	½W
R4.	Solid Carbon	100K	±10%	1/10W
R5.	Solid Carbon	A.O.T.	±10%	1/10W
R6.	High Stab.	22MΩ	±5%	¾W
R7.	Carbon Film	47KΩ	±5%	½W
R8.	Carbon Film	10KΩ	±5%	½W
R9.	Carbon Film	10KΩ	±5%	½W
R10.	High Stab.	330KΩ	±5%	½W
R11.	High Stab.	330KΩ	±5%	½W
R12.	High Stab.	5·1MΩ	±5%	½W
R13.	High Stab.	5·1MΩ	±5%	½W
R14.	High Stab.	470KΩ	±5%	½W
R15.	High Stab.	470KΩ	±5%	½W
R16.	High Stab.	47KΩ	±5%	½W
R17.	High Stab.	47KΩ	±5%	½W
R18.	High Stab.	6·8KΩ	±5%	½W
R19.	High Stab.	6·8KΩ	±5%	½W
R20.	High Stab.	1·5KΩ	±5%	½W
R21.	High Stab.	1·5KΩ	±5%	½W
R22.	High Stab.	680Ω	±5%	½W
R23.	High Stab.	680Ω	±5%	½W
R24.	Carbon Film	2·2KΩ	±5%	½W
R25.	Carbon Film	10Ω	±5%	½W
R26.	Carbon Film	15KΩ	±5%	½W
R27.	Carbon Film	6·8MΩ	±5%	½W
R28.	Carbon Film	1MΩ	±5%	½W
R29.	Carbon Film	10KΩ	±5%	½W
R30.	Carbon Film	1MΩ	±5%	½W
R31.	Carbon Film	47KΩ	±5%	½W
R32.	Carbon Film	2·2MΩ	±5%	½W
R33.	Carbon Film	470KΩ	±5%	½W

P A R T S L I S T

CIRCUIT REF.	DESCRIPTION			
	R E S I S T O R S			
R34.	Carbon Film	6·8KΩ	±5%	½W
R35.	Carbon Film	2·2KΩ	±5%	½W
R36.	Carbon Film	1MΩ	±5%	½W
R37.	Carbon Film	27KΩ	±5%	½W
R38.	Carbon Film	1MΩ	±5%	½W
R39.	Carbon Film	330KΩ	±5%	½W
R41.	Carbon Film	2·2KΩ	±5%	½W
R42.	Carbon Film	1MΩ	±5%	½W
R43.	Carbon Film	1KΩ	±5%	½W
R44.	Carbon Film	200KΩ	±5%	½W
R45.	Carbon Film	200KΩ	±5%	½W
R46.	Carbon Film	1MΩ	±5%	½W
R47.	High Stab.	560KΩ	±5%	½W
R48.	Carbon Film	20KΩ	±5%	½W
R49.	Carbon Film	1MΩ	±5%	½W
R50.	Carbon Film	1MΩ	±5%	½W
R51.	Carbon Film	220KΩ	±5%	½W
R52.	Carbon Film	1·2KΩ	±5%	½W
R53.	Carbon Film	1MΩ	±5%	½W
R54.	Carbon Film	680Ω	±5%	½W
R55.	Power Metox	20KΩ	±5%	2W
R56.	Power Metox	6·8KΩ	±5%	2W
R57.	High Stab.	10KΩ	±5%	½W
R58.	High Stab.	100KΩ	±1%	½W
R59.	High Stab.	9KΩ	±1%	½W
R60.	High Stab.	4·7KΩ	±5%	½W
R61.	High Stab.	5·6KΩ	±5%	½W
R62.	High Stab.	7KΩ	±1%	½W
R63.	Power Metox	62Ω	±5%	2W
R64.	Carbon Film	33KΩ	±5%	½W
R65.	Carbon Film	220KΩ	±5%	1W

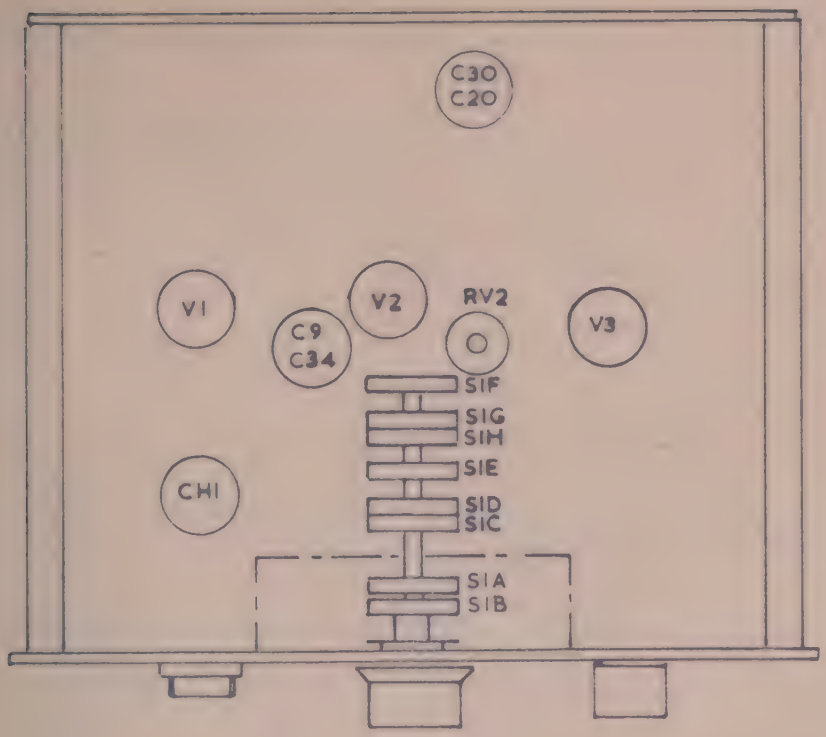
P A R T S L I S T

C A P A C I T O R S

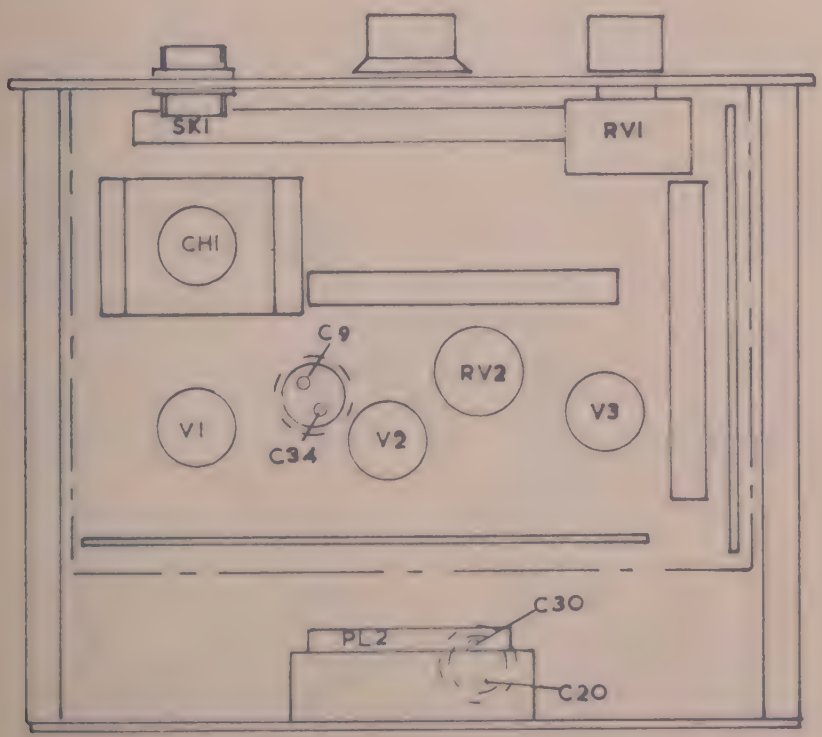
CIRCUIT REF.	DESCRIPTION		
C1.	Ceramic	1000pF	100V
C2.	Ceramic	1000pF	100V
C3.	Polyester	·1μF	30V
C4.	Polyester	·1μF	30V
C5.	Film	1μF	160V
C6.	Film	1μF	160V
C7.	Polyester	·0033	400V
C8.	Polyester	·022	160V
C9.	Electrolytic	50+50μF	275V
C10.	Ceramic	4700pF	500V
C11.	Electrolytic	50μF	12V
C12.	Electrolytic	50μF	12V
C13.			
C14.	Polyester	0·1μF	250V
C15.	Polyester	·047	160V
C16.	Polyester	0·1μF	250V
C17.	Polyester	0·1μF	250V
C18.	Foil	·047μF	160V
C19.	Polyester	·047μF	160V
C20.	Electrolytic	32+32μF	450V
C21.	Polystyrene	2000pF	125V
C22.	Electrolytic	100μF	12V
C23.	Polyester	·022	400V
C24.	Foil	·033	160V
C25.	Foil	·033	160V
C26.	Polyester	0·1μF	250V
C27.	Polyester	0·1μF	250V
C28.	Polyester	0·1μF	250V
C29.	Electrolytic	50μF	12V
C30.	See C.20		
C31.	Polyester	2·2μF	250V
C32.	Polyester	2·2μF	250V
C33.	Electrolytic	10μF	16V
C34.	See C9		
C35.	Ceramic	·01μF	500V
C36.	Disc	500pF	500V

PARTS LIST

CIRCUIT REF.	DESCRIPTION		
VALVES			
V1.	Double Triode	ECC83	Mullard
V2.	Pentode	EF86	Mullard
V3.	Triode-Pentode	ECF80	Mullard
POTENTIOMETERS			
RV1.	Wirewound lineár	50KΩ	
RV2.	Wirewound lineár	1KΩ	
RV3.	Carbon	5KΩ	
RV4.	Carbon	5KΩ	
RV5.	Carbon	5KΩ	
RV6.	Carbon	5KΩ	
RV7.	Carbon	5KΩ	
RV8.	Carbon	5KΩ	
RV9.	Carbon	5KΩ	
RV10.	Carbon	5KΩ	
RV11.	Carbon	5KΩ	
RV12.	Carbon	5KΩ	
RV13.	Carbon	5KΩ	
RV14.	Carbon	10KΩ	
RV15.	Carbon	25KΩ	
RV16.	Carbon	100KΩ	
RV17.	Carbon	250KΩ	
MISCELLANEOUS			
MR1.	Diode	S570G	Transitron
MR2.	Diode	S570G	Transitron
MR3.	Diode	OA91	Mullard
MR4.	Diode	1S44	Mullard
MR5.	Diode	OA91	Mullard
MR6.	Diode	1S44	Texas
CH1.	Chopper with magnetic screen.	C.K.3	A.E.I.
SK1.	Socket	80-PC2F	Amphenol Ltd.
PL1.	Plug	80-MC2M	Amphenol Ltd.
PL2.	Plug 16-way Dowel Polarised.	RP.D.16.	McMurdo
S1.	Switch	Dymar Drg. BD.1263	



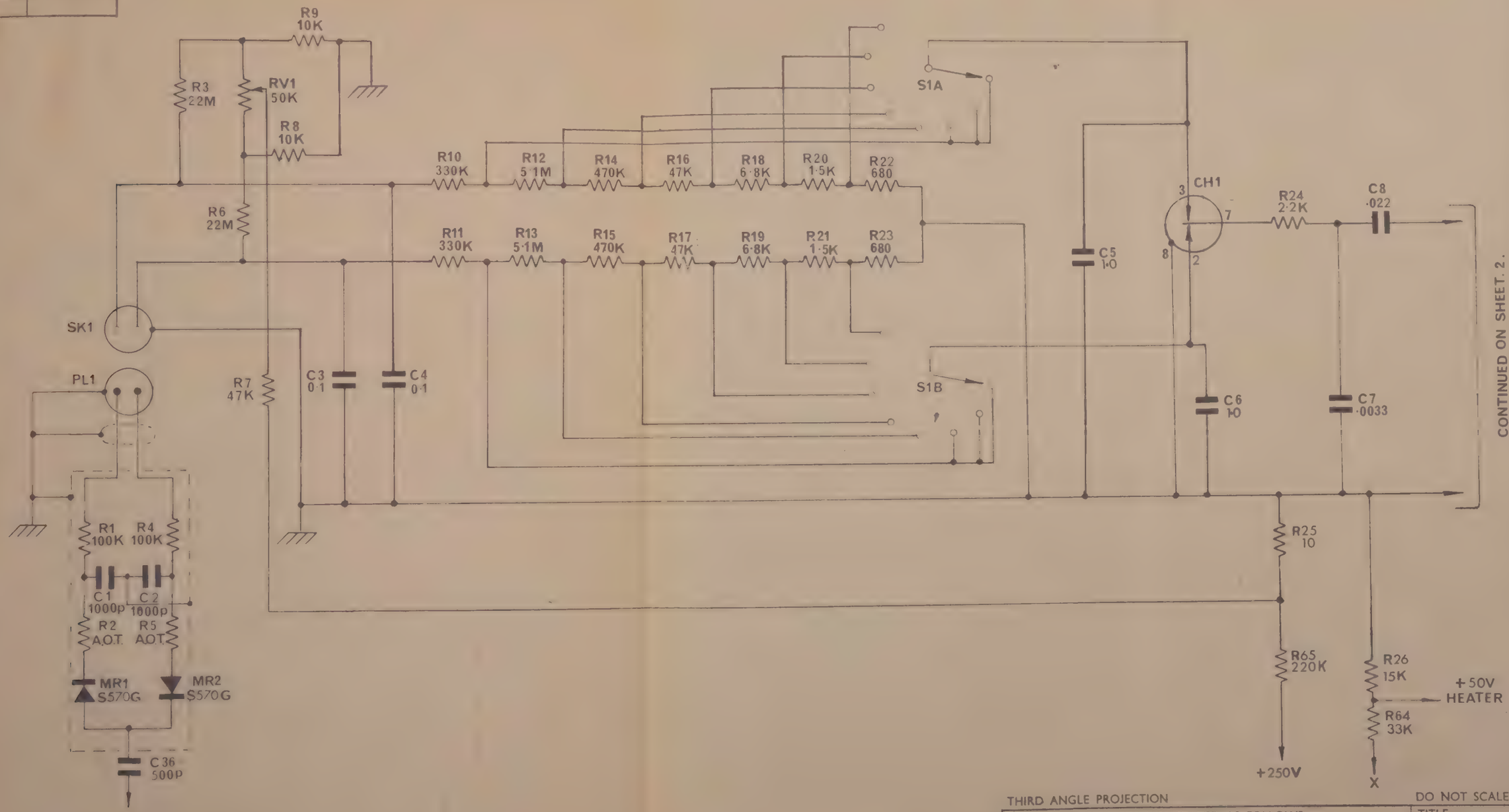
VIEW ON TOP OF CHASSIS



VIEW UNDER CHASSIS

DRG No. SHEET 1 OF 2 BC1262	
USED ON	ASSY. DRG. No.
TYPE 711	

ISSUE
A. 16.7.66
1. 18.10.66
2. C/N 711/2 27-1-67



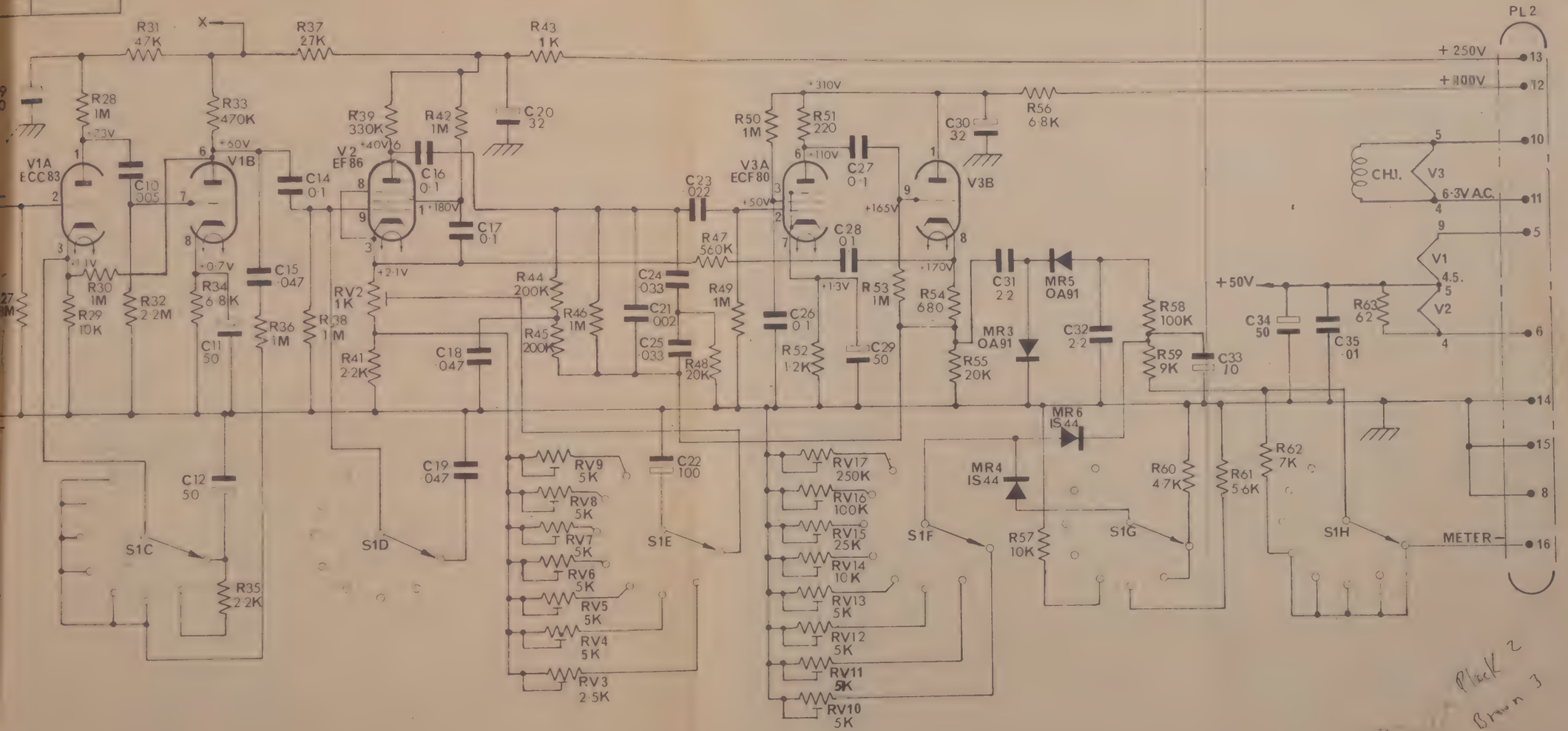
THIRD ANGLE PROJECTION — DO NOT SCALE

LIMITS UNLESS OTHERWISE STATED AS FOLLOWS FRACTIONAL DIMENSIONS ± ·015. CLEAR HOLES ± ·005 DECIMAL DIMENSIONS ± ·005. ANGLES ± ½°	TITLE CIRCUIT DIAGRAM. V.H.F. MILLIVOLTMETER.
DIMENSIONS APPLY BEFORE PLATING UNLESS OTHERWISE STATED	
MATL. SPEC.	DRG. No BC 1262 SHEET 1 OF 2
FINISH	DRN. J SOPPITT DATE 8·7·66
ALL DIMENSIONS IN INCHES SCALE	CHK'D DATE
DYMAR ELECTRONICS LTD. WATFORD, HERTS, ENGLAND.	APP'D DATE

SHEET 2 OF 2
BC1262

IN	ASSY DRG. No.
1	

ISSUE
A. 14.7.66
1. 18·10·66
2. 18·1·67
C/N711/2



THIRD ANGLE PROJECTION

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DIMENSIONS APPLY BEFORE PLATING UNLESS OTHERWISE STATED	
MAT'L / SPEC.	DRG. No BC1262 SHEET 2 OF 2
FINISH	DRN. J. SOPPITT DATE 8-2-66
ALL DIMENSIONS IN INCHES / SCALE	CHK'D DATE
DYMAR ELECTRONICS LTD. WATFORD, HERTS, ENGLAND.	APP'D DATE

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For components not of our manufacture we extend only such benefits as we may receive under any guarantee given to us by the makers thereof.

The liability of the Com any for consequential loss or damage suffered by the Purchaser of the goods supplied by it, however sustained is hereb expressly excluded.

Our equipment has been designed and tested for use with the specific types of components supplied by us therein and no responsibility can be accepted for the performance of the equipment if other components are employed.

In the event of failure or malfunctioning of any equipment supplied by us please contact our Service Department, at the below stated address and give full details of the fault together with the Type and Serial Number of the equipment in question.

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